TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL

ARMY MODEL
AH-IP (PROD)
AH-1E (ECAS)
AH-1F (MODERNIZED COBRA)
HELICOPTERS

HEADQUARTERS, DEPARTMENT OF THE ARMY
8 MAY 1980

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DEPARTMENT OF THE ARMY
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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of away to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications end Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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CHAPTER 7

HYDRAULIC AND PNEUMATIC SYSTEM

7-1. HYDRAULIC SYSTEM.

NOTE

Refer to paragraph 7-145 for description of hydraulic system for helicopters coded E and helicopters coded M .

7-2. DESCRIPTION – HYDRAULIC SYSTEM.

a. Two similar but separate hydraulic systems are used to operate flight control power cylinders, stability and control augmentation system (SCAS) servoactuators, the armament turret, and the TOW missile launcher actuator. A schematic diagram of the hydraulic system for helicopters coded P is shown on figure FO-1 (foldout page FO-1). System No. 1 and No. 2 are exactly alike as to their reservoirs, transmission driven pumps, and module assemblies which contain system filters, solenoid valves, relief valves and pressure switches for the caution panels. Although both systems operate three dual servo hydraulic cylinders in main rotor controls there is no connection between systems because they separate passages and piston chambers inside each dual cylinder and valve assembly. Both systems and the emergency system also have other hydraulic circuits and functions different and separate from each other.

b. An emergency system is provided to enable the pilot to execute a landing in the event that pressure is lost in both System No. 1 and System No. 2. The emergency systems consists basically of a pressurized lockout valve, a pressure operated shutoff valve, solenoid operated shutoff valve, and check valves. See schematic diagram, figure FO-1 (foldout page FO-1). If the pressure in hydraulic System No. 1 should fall to 650 psig for any reason, the pressurized lockout valve and the pressure operated shutoff valve will close, locking 650 psig on both pressure and return sides of the servo-actuators. This is done to ensure that the actuators remain full of oil and free of air. A small accumulator, **1.0** cubic inch, is connected to the pressurized lockout valve to make up normal leakage of the cyclic actuators and to help maintain the 650 psig trapped in the actuators. The pilot can then move the flight controls by engaging the mechanical stops on the servo-actuators and moving the cylinders through direct mechanical coupling and internal irreversible valving. When the pilot moves the servo-actuator with no hydraulic pressure available, the fluid is moved from one side of the actuator to the other through flow passages in the actuator head. When the feed-back forces exceed the pressure setting of the differential relief valve, the valve will open, allowing a slight amount of fluid bypass through the actuator pressure to actuator return passages. This will warn the pilot of an overloading condition.

c. An emergency system is provided to furnish hydraulic power to the collective hydraulic cylinder when pressure is lost in System No. 1 and System No. 2. The emergency system consists basically of an electric driven pump, reservoir, solenoid valves, filter, check valves, and pressure switch. The system is also used to power turret and wing, pylon armament systems for boresight capability without hydraulic test stand. The description of the emergency system in paragraph b is applicable to the cyclic control hydraulic cylinders and to the collective control hydraulic cylinder except that when the emergency electric hydraulic pump switch is positioned to "emergency" hydraulic fluid under pressure will be supplied to the collective cylinder. The remainder of System No. 2 will be closed off by solenoid valves. The primary purpose of the emergency systems is to ensure that hydraulic power is furnished to the collective hydraulic cylinder. The pilot cannot maintain collective control without hydraulic pressure at the collective hydraulic cylinder.

d. In the event of a dual hydraulic system and starter/generator failure, the emergency electrical system, with a fully charged battery, is capable of supplying the essential bus loads for at least 17.8 minutes, with the emergency hydraulic pump being used during low speed flight prior to landing, and, during landing operations not to exceed 5 minutes.

7-3. OPERATIONAL CHECK AND TESTING – HYDRAULIC SYSTEM.

The following principles of operation of System No. 1, System No. 2, and emergency system inform the mechanic how each system functions prior to

performing testing and operational checks of hydraulic systems after maintenance requirements have been accomplished.

a. Principles of Operation (typical for both systems).

In normal operation of each system, hydraulic fluid is supplied from its nonpressurized reservoir by gravity feed and suction to a transmission-driven pump. The pump is a variable-displacement type with internal pressure compensation, preset to provide **1500** (plus or minus **25)** psi output pressure and **6.1** gpm flow rate at operating rpm, according to system demands. Fluid bypassed in pump, to regulate pressure and flow, is released through a line to the return side of the hydraulic modular unit. Pump output is delivered to the module and passes through the pressure filter. A relief valve in the module guards the system against excessive pressure, relief valve is set to open at **1626 TO 2140** psi. The system solenoid valve is normally de-energized and open to the SYS PRESS outlet of the modular unit but can be electrically energized to bypass position by placing the HYD TEST switch to position marked for opposite system. A pressure switch will cause the caution panel to light if modular unit outlet pressure decreases (at **600** TO **400** psi).

(1) Beyond the modular unit, fluid under pressure is delivered through tubes and hoses to three dual hydraulic servo cylinders in main rotor cyclic and collective control systems. Fluid flows into and out of one functional half of each dual cylinder when its servo control valve is moved mechanically by linkage from a control stick, causing the cylinder piston rod to make corresponding movements of linkages to the main rotor. The cylinder valves also have internal functions which tend to prevent feedback of motion from the rotor to the control stick. Either system alone can operate the cylinders, but the dual (or tandem) arrangement is used for added safety of operation.

(2) Fluid is returned from power cylinders and other units through external lines to the SYS RET inlet of the module, to pass through the return filter. Normal return flow from module to reservoir is through a hose connected on the quick-disconnect coupling which is at other times used to connect ground test equipment, However, if this hose has not been connected, a low pressure **(45** psi) will open a relief valve and allow flow through another line from the module RES RET outlet to the reservoir BYPASS inlet.

(3) Both hydraulic modular units are equipped with quick disconnect couplings to allow ground operation with a portable hydraulic test stand (S2). System operation with such a unit is the same as described for normal operation, except that the reservoir and transmission-driven pump are not being used. External dc power will also be required for electrically operated valves, caution panels, and electric driven hydraulic pump when engine is not operating.

b. Special Functions of System No. 1.

In addition to typical operation described in preceding paragraphs for both systems, hydraulic System No. 1 has the following special functions:

(1) Tail rotor controls hydraulic cylinder. This is a single hydraulic cylinder and servo valve assembly, mechanically connected into control linkage to the tail rotor.

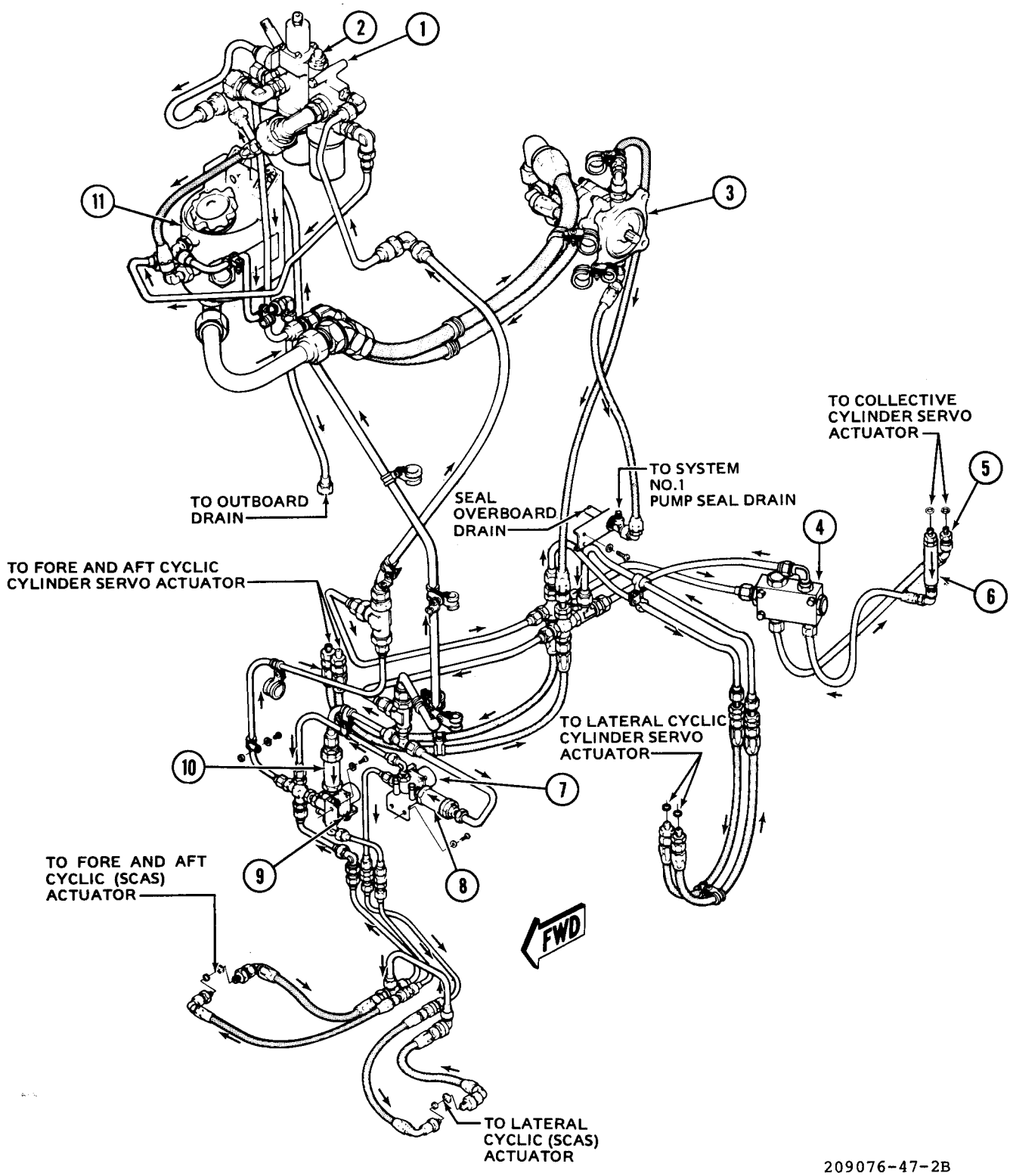
(2) Yaw stability and control augmentation system (SCAS) servo actuator. This circuit includes a pressure line filter, a three-way, two-position solenoid valve, and an electro-hydraulic servo actuator connected in the tail rotor control linkage.

c. Special Functions of System No. 2.

In addition to typical operation described for both systems in paragraph 7-2, hydraulic System No. 2 has the following special functions:

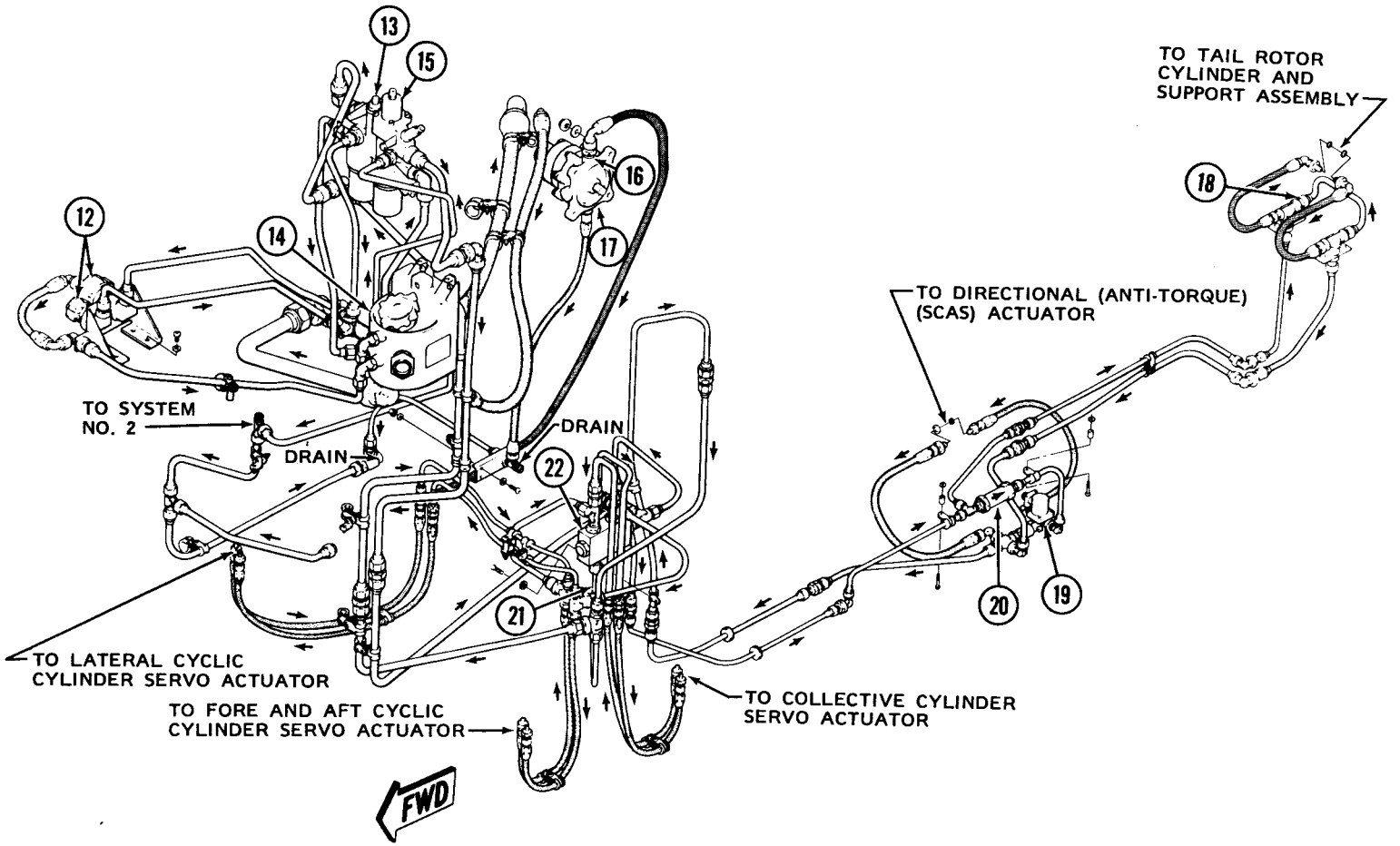
(1) Armament system hydraulic power provisions (figures 7-1, 7-2, and FO1). This circuit provides pressure and return hydraulic lines to couplings where the M28A1E2 armament turret hydraulic system is connected. The pressure line includes a two-way, two-position solenoid shutoff valve, controlled by the armament panel MASTER ARM switch, a directional flow check valve, and a bypass with a check valve to relieve pressure when solenoid is off. The return line has a directional flow check valve. A bypass line with a relief valve is installed around the flow check valve in the pressure line.

(2) Pitch and roll stability and control augmentation system (SCAS) actuators. Circuits are provided for pitch and roll functions of stability augmentation system. Each of the two circuits includes a pressure line filter, a three-way two-position solenoid valve, and an electro-hydraulic



System No. 2

Figure 7-1. P | Hydraulic System (Sheet 1 of 5)



System No. 1

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Figure 7-1. P Hydraulic System (Sheet 2 of 5)

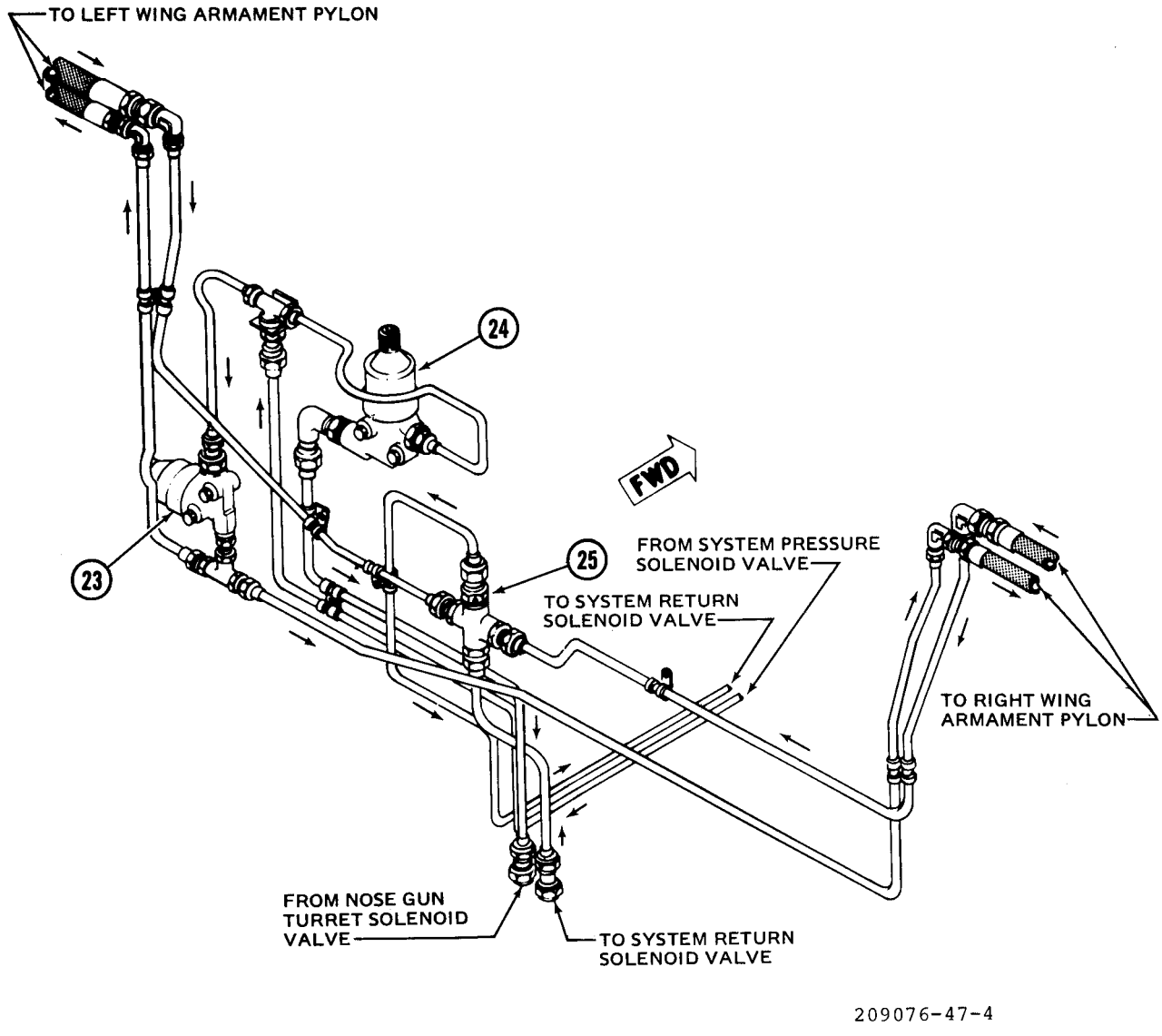

Figure 7-1. P Hydraulic System (Sheet 3 of 5)